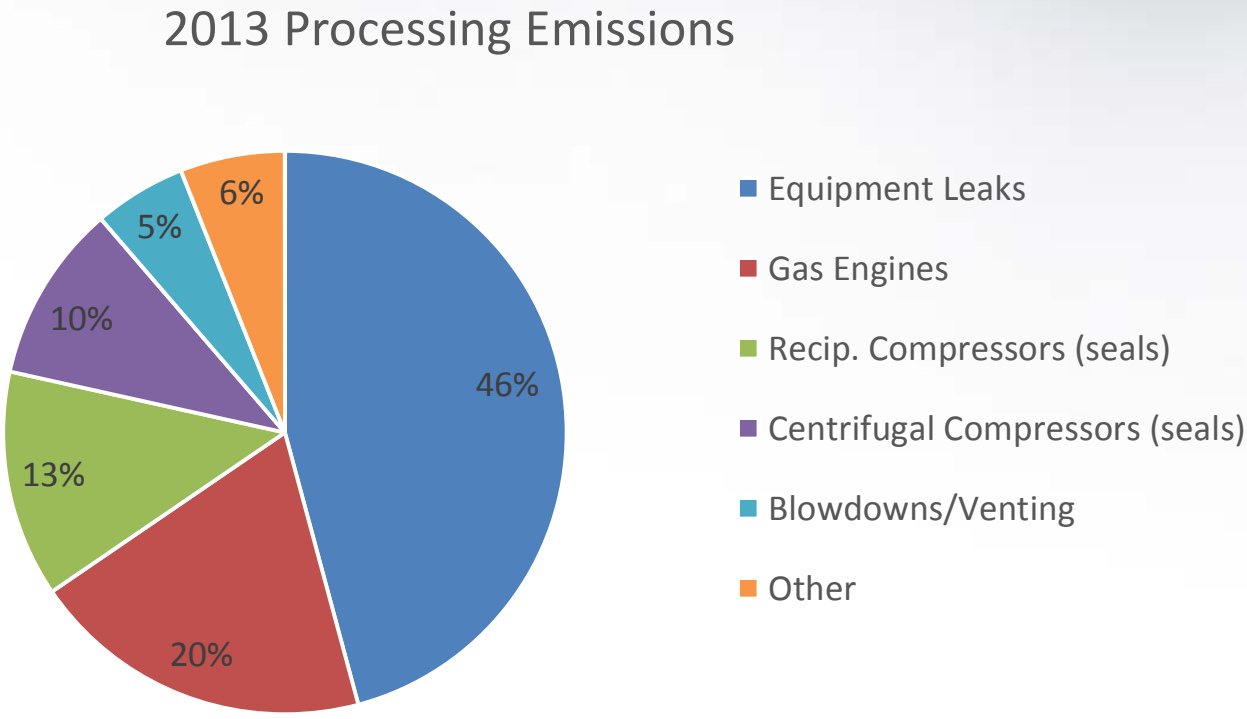
Natural Gas Processing and Gathering and Boosting in the 2016 GHGI

Overview of Potential Methodology Updates

November 19, 2015

Processing in 2015 GHGI

- 22.7 MMT CO_2e
- 14% of natural gas systems methane emissions



Processing Emissions in the GHGI

- Activity Data
  - Activity factors are based on 1996 EPA/GRI factors
    - e.g., number of acid gas removal units or compressor hp-hr per unit throughput
  - Throughput and plant counts obtained from annual EIA and O&GJ data.

- Emission Factors
  - All EFs except centrifugal compressor seals are based on EPA/GRI (1996).
  - Centrifugal compressor seals EF based on a World Gas Conference paper (wet seals), and data from Gas STAR partners (dry seals)

New data on Processing

- GHGRP
  - Data from 2011-2014
  - See next slide

- Marchese et al.
  - Measured methane plumes from 16 sites
  - Year 2013/2014 data
  - Scaled to national level using EIA and O&GJ databases

Available GHGRP Data-Processing

Emission Source	Reported Data
Reciprocating compressor venting	Activity (compressor size, hours of operation by mode, emission controls) and EFs (by operating mode)
Centrifugal compressor venting	Activity (compressor size, hours of operation by mode, emission controls, seal type) and EFs (by operating mode)
Blowdown vent stacks	No activity or EF; annual total emissions by equipment type and event type
Dehydrator vents	Activity (including throughput, controls, etc. for large units) EFs for large units; small units use rule-provided EF
Acid gas removal vents	Activity (throughput by unit and portion of CO_2 recovered for other uses) and EF per unit
Flare stack emissions	Activity (including throughput, etc.) and EF per flare
Equipment leaks	Activity (component type, # leaking comps, time leaking) Annual emissions by component type based on rule-provided EFs

Processing Facilities: Comparison between Current GHGI and Marchese et al.

- Marchese et al. compared findings to year 2012 estimates in the 2015 GHGI:

Parameter	Marchese et al.	2015 GHGI
Normal operations	506 Gg	851 Gg
Routine maintenance	-	40 Gg
Reciprocating compressors per site	6.4	9.3
Reciprocating-to-centrifugal compressor activity ratio	2.6	6.2

Gathering & Boosting Emissions in the GHGI

- Gathering is integrated with well pad activities into production segment of Natural Gas Systems in GHGI
- Production emissions are calculated for 6 NEMS regions
- GHGI sources that are predominantly in gathering:
  - Large reciprocating compressors
  - Large reciprocating stations
  - Pipeline leaks
  - Pipeline blowdowns
  - Pipeline mishaps
- These predominantly gathering sources = 9% of net production emissions

Gathering & Boosting Emissions in the GHGI (cont.)

- Gathering sources that cannot be straightforwardly disaggregated from well-pad activities in GHGI:
  - Fugitive equipment leaks (heaters, separators, dehydrators, meter runs)
  - Pneumatics (valves and pumps)
  - Condensate tanks
  - Vessel blowdowns and releases.
- Mixed sources = over half of net production & gathering total methane
- Large reciprocating compressors and stations are most comparable to the Marchese et al. study of gathering facilities

Gathering: Large Reciprocating Compressors and Stations, Current Inventory Method

- Activity Data
  - EPA/GRI (1996) survey of 13 production companies to estimate stations per mile of gathering lines and gathering pipeline miles per gas well.
  - EPA/GRI activity factor used in conjunction with number of gas wells in a given year from Drilling Info data.

- Emission Factors
  - Same EFs for all 6 NEMS regions
  - Adapted from EPA/GRI emission tests on transmission compressor stations
  - Includes: valves, connections, relief valves, station and compressor blowdowns, compressor starts, seal leaks.

New data on Gathering and Boosting

- GHGRP
  - Gathering data will begin collecting gathering and boosting data in 2016 (to be reported to EPA in 2017)

- Marchese et al.
  - Measured methane plumes from 114 sites
  - Year 2013/2014 data
  - Scaled to national level using state permit databases

Requests for Stakeholder Feedback

- Are other new data sources available for processing or gathering and boosting?
- Please comment on approaches for incorporating new processing data (e.g. GHGRP, Marchese)
- There are several potential approaches to address gathering and boosting in the GHGI. Please comment on these approaches.
  - Maintain current inventory structure with aggregate estimates for production and gathering
  - Separate gathering from production, and continue to estimate emissions on a source-by-source basis
  - Separate gathering from production, and use station-level factors (e.g., those from Marchese)